

Taxonomic notes on a collection of Rhinolophidae (Chiroptera) from Northern Thailand, with a description of a new subspecies of *Rhinolophus robinsoni*

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Abstract

Rhinolophus robinsoni siamensis subsp. nov. is described from specimens recently collected by members of the National Speleological Society, USA, Thailand Karst Hydrologic Expedition in extreme northwestern Thailand. The new subspecies is shown to be a large representative of a taxa that exhibits strong geographical variation. *R. r. siamensis* is hypothesised to have originated as a Pleistocene relict form isolated in northwestern Thailand by climatic events. Specimens of *R. malayanus* are also described together with comments on intraspecific variation and on their relationship to *R. steno*. Finally, we briefly report on a specimen of *R. yunnanensis*, and document the ecological circumstances in which the collections were made.

Introduction

The Thailand Karst Hydrologic Survey, an expedition which was fielded by members of the National Speleological Society, USA, between December 1983 and February 1984, provided an opportunity to obtain specimens of cave-dwelling bats from the limestone mountains of extreme north-western Thailand. Twenty-three bats of the Family Rhinolophidae were deposited in the collections of the Natural History Museum of Los Angeles County (LACM), and are reported on here.

All of the bats were obtained from limestone caves, including pits, stream passages, and dry tunnels. No particular ecological preferences were apparent from the field notes of the collectors. *Rhinolophus malayanus* were found roosting in colonies numbering several hundred, whereas *R. yunnanensis* was collected from a small colony of 6–8 individuals. *R. robinsoni* were found roosting solitarily, or in groups of two or three. Typical cave temperatures were of the order of 14°C.

Systematic accounts

Rhinolophus malayanus Bonhote, 1903

Specimens collected: Northern Thailand; Chiang Dao Mountain, Mai Pas Ao resurgence cave; 19° 23' N, 98° 54' E; LACM 70302–70317; collected by R. HEMPERLY, 6/7 January 1984; in alcohol, LACM 70305 with skull extracted. Northern Thailand, Aungkang Region, Big House Cave. 19° 50' N, 99° 10' E; 1 ♂; LACM 70325; collected by J. BENEDICT, 12 January 1984; in alcohol, skull extracted. Comparative material examined: *Rhinolophus malayanus* Laos, Plateau Bolovens; 1 ♂; AMNH 87302; collected 4 February 1932; skin and skull. *Rhinolophus malayanus* Thailand, Chiang Dao Mountain; 1 ♀;

AMNH 167936; collected 11 March 1954; skin and skull. *Rhinolophus stheno* Malaya, Pahang, 2 miles west of Karak, 1 ♂, 1 ♀; LACM 53843–53844; collected by LIM BOO LIAT 26 July 1966; skins and skulls. *Rhinolophus stheno* Malaya, Pahang, Gunong Benom; 2 ♂; AMNH 216905–216906; collected 30 January 1968; identified by Lord MEDWAY; skins and skulls.

Measurements: Mean length of forearm = 42.8 (N = 12, SD = 1.16); mean length of phalanx I, digit III = 13.6 (N = 11, SD = 0.49); mean length of phalanx II, digit III = 19.5 (N = 11, SD = 1.24); total length of skull = 18.7–19.5 (N = 2); least interorbital width = 2.50–2.55 (N = 2); width of braincase = 8.7–9.0 (N = 2); Width across canines = 4.35–4.45 (N = 2); length, C–M3, = 6.55–7.25 (N = 2);

Remarks: LEKAGUL and MCNEELY (1977) summarize the taxonomy of *Rhinolophus malayanus* and *R. stheno* by distinguishing the two species on the basis of size, lancet shape, and particularly the relative proportions of the first and second phalanges of the third digit. These authors also recognize two colour phases in *R. malayanus* – “cinnamon” and “brown” upper parts respectively, – but only a single “reddish brown” phase for *R. stheno*.

We have independently examined lancet shape in the seventeen fluid preserved specimens of *R. malayanus* reported in this study, and compared them with independently identified specimens of *R. malayanus* and *R. stheno* at this Institution (LACM) and on loan from the American Museum of Natural History (AMNH). We are unable to recognize any consistent or reliable variation in lancet shape between the two species, other than that directly attributable to the drying effects of study skin preparation.

With regard to colour phases, both specimens of *R. stheno* in the LACM collection (LACM 53843 and 53844) have a distinctive “cinnamon brown” dorsal pelage, lighter below. In contrast the AMNH specimens which were also collected from the Pahang region of Malaya were of two colours (following RIDGEWAY 1912), Argus Brown (AMNH 216905) and the cinnamon-like Sanford’s Brown (AMNH 216906). We therefore conclude that *R. stheno* exists in two colour phases without geographical distinction, as has been documented for *R. malayanus*.

The specimens of *R. stheno* available to us were larger than the measurements for *R. malayanus* given by LEKAGUL and MCNEELY (1977), but we were concerned by the variation in size of the sixteen adult *R. malayanus* from a single cave population reported on here, and by the apparent relationship between body size and the critical ratio of phalanges lengths in digit 3. In fact, the mean forearm length of these 16 *R. malayanus* differs from that of the smallest *R. stheno* available to us (AMNH 216906) by less than 1.68 standard deviations, indicating that there is a 5 % probability of overlap between specimens of the two species. This probability of overlap might be much larger if *R. malayanus* from several cave populations were used.

A plot of forearm length against the ratio of phalanx I to phalanx II of digit 3 for both *R. malayanus* and *R. stheno* is presented in figure 1. There is a clear relationship between increasing wing size and increasing phalanges ratio indicated by a regression line slope significantly greater than zero ($P = 0.0001$) and an excellent fit of the line to the data ($r^2 = 0.95$).

In summary, we conclude that there are no reliable differences between the nominal species *R. malayanus* and *R. stheno* with regard to lancet shape or body size, that the character of phalanges ratio is an artifact of variations in wing length, and that the colour phases documented for *R. malayanus* are duplicated in *R. stheno*.

R. stheno can be distinguished from *R. malayanus* on the basis of cranial characters; in *stheno* the supraorbital region is shorter and broader than in *malayanus*, and the anterior rostral swellings are less well developed and do not extend laterally down the rostrum as they do in *malayanus*. The supraorbital region between the supraorbital ridges is elevated in *R. malayanus* except posteriorly where there is a shallow depression, and it does not

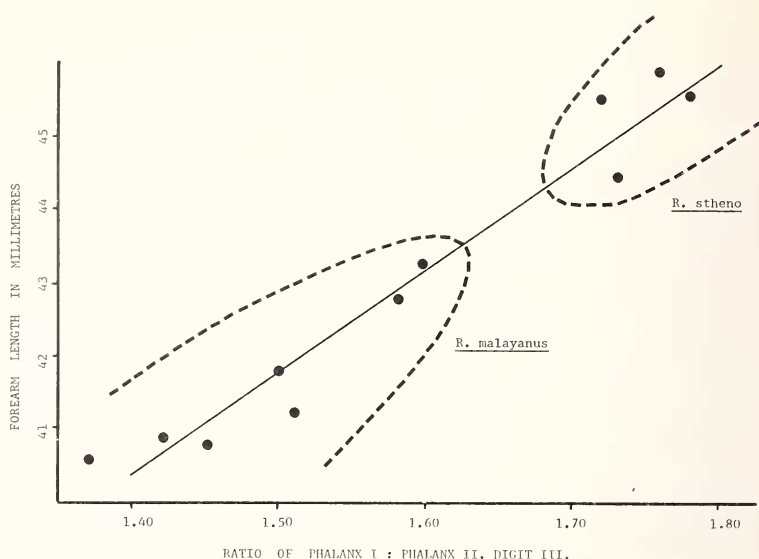


Fig. 1. The relationship between phalanges ratio and wing size in two species of Thai *Rhinolophus*

extend anteriorly between the posterior median nasal swellings. In *R. stheno* the supraorbital region is markedly depressed and extends as a narrow sulcus between the posterior median nasal swellings (J. E. HILL, pers. comm.). These characters notwithstanding, the *R. malayanus* reported here are sufficiently similar to the *R. stheno* available to us to warrant the conjecture that these taxa may be more closely related than has hitherto been supposed.

Rhinolophus robinsoni siamensis subsp. nov.

Holotype: Northern Thailand; Aungkang region; Big House Cave; 19°50' N, 99°10' E; 1 ♂; LACM 70322; collected by R. HEMPERLY 12 January 1984, as part of the National Speleological Society North Thailand Hydrologic Survey. In alcohol, skull extracted.

Additional Material: Northern Thailand; Aungkang region; Big House Cave; 19°50' N, 99°10' E; 1 ♀; LACM 70326; collected by R. HEMPERLY, 12 January 1984; in alcohol. Northern Thailand; Aungkang region; Hill Pit Cave; 19°50' N, 99°10' E; 1 ♂, LACM 70327; collected by J. BENEDICT, January 1984; in alcohol. Northern Thailand; Chiang Dao Mountain; "2nd Pit"; 19°23' N, 98°54' E; 1 ♂; LACM 70320; collected by R. HEMPERLY, 7 January 1984; in alcohol, skull extracted.

Diagnosis: Very similar to *Rhinolophus robinsoni robinsoni* Andersen, 1918, but of significantly larger size; forearm 48 mm or larger, tibia more than 23 mm. *R. robinsoni siamensis* is further distinguished by having its second lower premolar (pm3) only partially extruded from the toothrow, with a narrow but distinct space separating pm2 and pm4.

Description: A medium sized *Rhinolophus* of the *ferrumequinum* group of TATE and ARCHBOLD (1939), with large ears and a distinct antitragal lobe. The lancet is cuneate, the sella wide at its base but constricted just above the midpoint, and the connecting process low and inserted on the posterior leaf no higher than the point of insertion on the back of the sella. The second phalanx of the third digit is short, being less than one and a half times the length of the first phalanx.

The skull exceeds 20 mm in greatest length, has a clearly defined frontal depression, and

prominent nasal swellings (Fig. 2). The anterior upper premolar is in the toothrow and contacts the canine and posterior premolar. The second lower premolar (pm3) is small and largely extruded from the toothrow, but not to the extent that pm2 and pm4 are in contact.

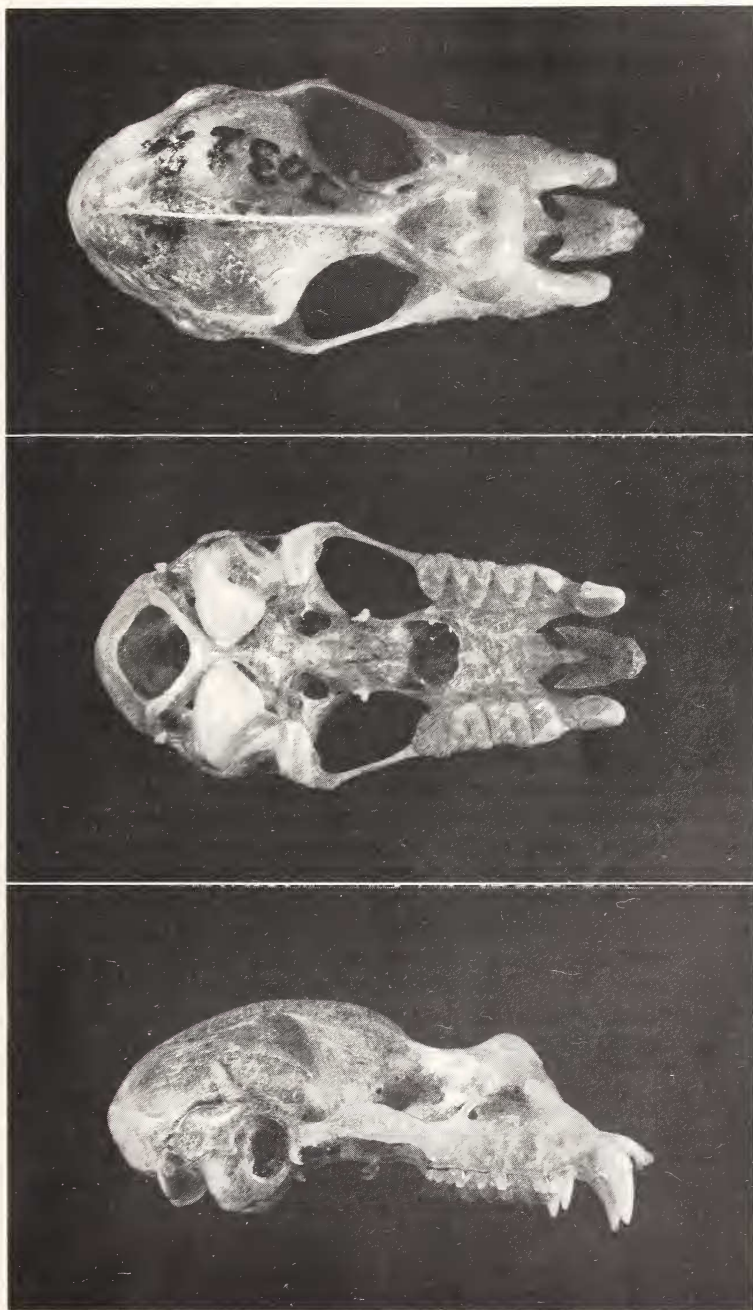


Fig. 2. The Skull of *Rhinolophus robinsoni siamensis* (Holotype), LACM 70322 ♂

Selected external and cranial measurements of the type, three paratypes, and the types of *R. r. robinsoni* and *R. r. klossi* are presented in Table 1.

Etymology: The subspecific name reflects the country of origin of the specimens, formerly the Kingdom of Siam.

Remarks: HILL (1972) has distinguished two subspecies of *Rhinolophus robinsoni*, *R. r. klossi* and *R. r. robinsoni*, on the basis of overall differences in size and the relative spacing of pm2 and pm4. Figure 3 plots two standard external size measurements using published values for HILL's specimens and those taken from the four specimens reported in this study. There is a clear separation of size classes between the three subspecies recognized here. *R. r. siamensis* differs in mean forearm length from *R. r. klossi* by at least six standard deviations, and from the forearm length of the type of *R. r. robinsoni* by at least four standard deviations.

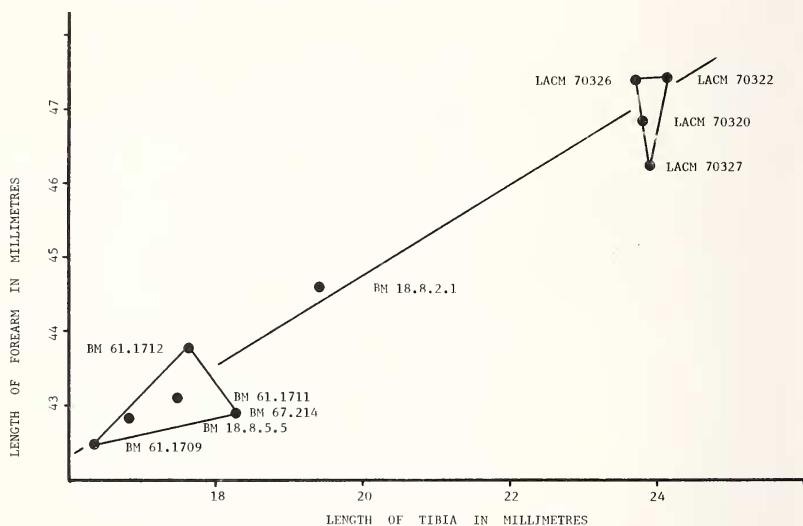


Fig. 3. Size classes of three subspecies of *Rhinolophus robinsoni*

A linear regression analysis of forearm lengths on the latitude of the collecting localities reveals a slope that is significantly greater than zero ($P = 0.0001$, $r^2 = 0.95$) which raises the possibility that all three groups of the *R. robinsoni* complex may be members of a contiguous, clinal population. However, we feel that the weight of circumstantial evidence is against this possibility. The north Thailand specimens were collected from caves in the dry deciduous limestone forest mapped by LEKAGUL and McNEELY (1977), whereas *R. r. robinsoni* and *R. r. klossi* were collected from the semi-evergreen or evergreen tropical rainforest of the Malay Peninsula. The known occurrences of *R. r. klossi* and *R. r. siamensis* are in mountainous areas 1800 km apart and separated by the Isthmus of Kra. *R. r. robinsoni* is reported only from south of the Isthmus. The importance of the Isthmus of Kra as a faunistic hiatus has been widely recognized (e.g. WALLACE 1876; CHASEN 1940; FOODEN 1975) and forms the boundary between the Indochinese and Sundaic zoogeographic subregions. LEKAGUL and McNEELY (1977) have argued that the relatively moist (total annual rainfall 2500+ mm) semi-evergreen forest of the Malay Peninsula would have been much less severely impacted by Pleistocene climatic fluctuations than the dry deciduous limestone forest of northwestern Thailand (annual rainfall 1200–1400 mm). In addition, TRAUB (1975) has shown that the mountains of northern Thailand are faunistically isolated from the lowlands to the south. Thus we follow HILL in retaining subspecific

status or *R. r. klossi* and *R. r. robinsoni* and erect the subspecies *R. r. siamensis* which we consider to be a Pleistocene relict population isolated in northwestern Thailand by the late Quaternary oscillations of forest communities.

Rhinolophus yunanensis Dobson, 1872

Specimens collected: Northern Thailand; Chiang Dao Mountain; Lumu Cave; 19° 23' N, 98° 54' E; 1 ♂, 1 ♀; LACM 70318–70319; collected by R. HEMPERLY, 6 January 1984. In alcohol, LACM 70319 with skull extracted.

Measurements: Length of forearm = 58.4–58.9 (N = 2); length of phalanx I, digit III = 19.0–19.1 (N = 2); length of phalanx II, digit III = 29.4–30.2 (N = 2); total length of skull = 27.55 (N = 1); least interorbital width = 2.65 (N = 1); width of braincase = 11.8 (N = 1); width across canines = 6.45 (N = 1); length, C–M3 = 10.40 (N = 1).

Remarks: *Rhinolophus yunanensis* is very similar to *Rhinolophus pearsoni* but HILL (1975) recognizes two distinct size categories of specific rank. Our small sample falls comfortably within the size range of the *yunanensis* group and sheds no further light on the matter.

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Zusammenfassung

Taxonomische Ergebnisse einer Sammlung von Fledermäusen (Rhinolophidae, Chiroptera) aus dem Nordwesten von Thailand und Beschreibung einer neuen Unterart von Rhinolophus robinsoni

Rhinolophus robinsoni siamensis subsp. nov. wurde anhand des Materials beschrieben, das von den Mitgliedern der „National Speleological Expedition, USA, Thailand Karst Hydrological Expedition“ im hohen Nordwesten Thailands gesammelt wurde. Die neue Unterart repräsentiert eine große Form dieses Taxons, das eine starke geographische Variabilität besitzt. Es wird angenommen, daß *Rhinolophus robinsoni siamensis* als pleistozäne Reliktform durch klimatische Vorgänge im Nordwesten Thailands isoliert wurde. Weiter werden Exemplare von *Rh. malayanus* unter Berücksichtigung intraspezifischer Variation und der Beziehung zu *Rh. steno* sowie kurz ein Individuum von *Rh. yunanensis* beschrieben. Die ökologischen Bedingungen, unter denen die Sammlung erfolgte, werden dargelegt.

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